# PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

**Patent Office**
**Canberra**

I, SMILJA DRAGOSAVLJEVIC, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Complete specification in connection with Innovation Patent No. 2002100817 for a patent by MIKE PATTERSON, LES JONES and CHRIS GEDDES as filed on 17 October 2002.

WITNESS my hand this
Third day of September 2003

S. Dragosavljevic

SMILJA DRAGOSAVLJEVIC
TEAM LEADER EXAMINATION
SUPPORT AND SALES

**AUSTRALIA**

The Patents Act 1990

COMPLETE SPECIFICATION

INNOVATION PATENT

# "SOLAR TRACKING DEVICE"

**The following statement is a full description of this invention, including the best method of performing it known to me.**

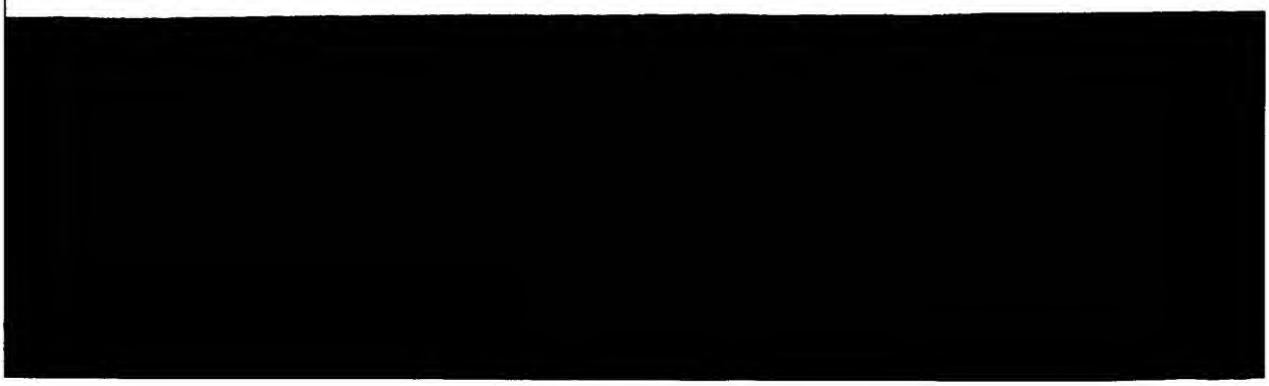
[redacted]

The present invention relates to a solar tracking device.

It is an object of the present invention to provide a simple and rugged method of ensuring the optimum positioning of solar collector panels.

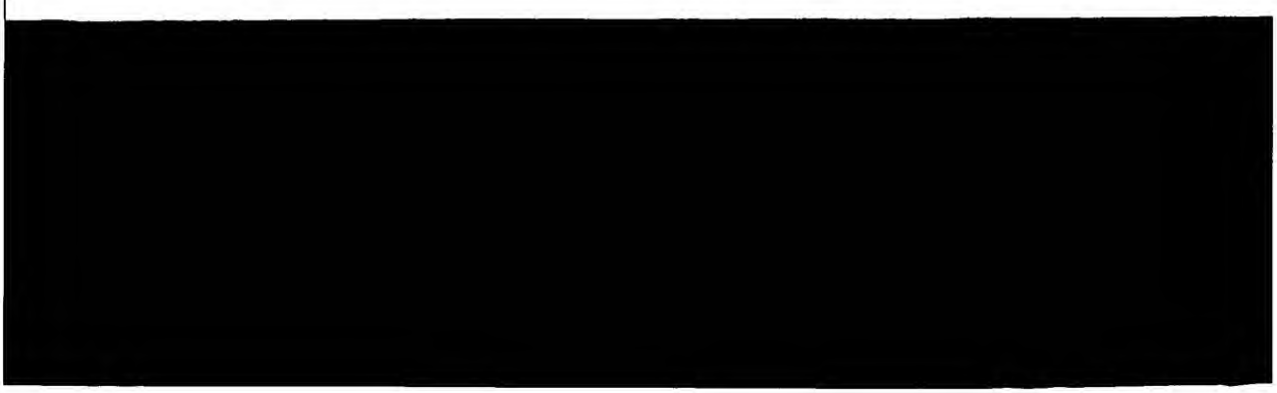
A further object is to reduce the cost of providing electrical energy using photovoltaic cells by maximizing the period of time during the day that the solar collector is pointed toward the sun.

With these objects in view the present invention in a preferred aspect may provide a solar tracking device including a mounting bracket in which is located a thermal hydraulic cylinder. A liquid contained within the said cylinder has optimal thermal expansion properties and is heated and cooled by variations of ambient air temperature. A displacement ram protrudes through a sealing gland at the base of said cylinder and has a damper plate fixed to the innermost end. The said damper plate assists with concentric location of said ram and is pierced to permit a gradual flow of liquid through said damper plate. A ferule is fixed at the outermost end of said ram and a pin is rotatably mounted through the said ferule and fixed to the bottom exterior of the said mounting bracket. A clevis is fixed to the top of the said cylinder through which a pin is fitted making a rotatable connection between the said cylinder and the two-axis pivot tube. A second pin passes through the said two-axis pivot tube, parallel to the first pin and a distance from it. The second pin is fixed through the upper sides of the said mounting bracket and rotatably locates the said two – axis pivot tube. The said pivot tube is rotatably mounted to two panel support brackets at each of its



ends by retainer bolts. The two said retainer bolts are located at the North and South extremities of the said two-axis pivot tube and permit the solar panel and attached expansion tubes / rotation ram assembly to rotate toward and away from the rising and setting sun and to track the sun through the day. The said expansion tubes are filled with the same liquid as the said thermal hydraulic cylinder. The said expansion tubes are coated on their upper surface with a material selected for optimal radiant heat energy absorption properties and the under surface is coated with a material selected to minimize the loss of radiant heat energy. The expansion tubes are completely coated or encapsulated in a transparent material to reduce loss of heat from convection with air currents. The said expansion tubes are attached to the rotation ram assembly by a secure and pressure resistant means and in such a manner to permit said liquid to freely pass between said expansion tubes and said rotation ram assembly. The said rotation ram assembly is comprised of a tubular cross supported on two ends by insulating bushes fitted into mounting holes located out board of the said panel support brackets. The cylindrical section of the rotation ram assembly at right angles to the supported tube has at the outermost end, a threaded section on which is screwed an adjustable cap fitted with a pressure seal permitting fine adjustment of the internal volume of the said expansion tube / rotation ram assembly. At the innermost end of the cylinder there is located a sealing gland through which the rotation ram is reciprocally fitted. The internal end of the rotation ram has a damper plate fixed in the same manner and purpose as described for the said thermal hydraulic cylinder.

A compression coil spring is located between the damper plate and the sealing gland, to return the solar panel and attached components to their eastern most position during the evening. The external section of the rotation ram has a bent



section to provide leverage and clearance from the mounting bracket, at the end of which is located a ferrule pivotally fitted to the compensating link which in turn is pivotally pinned to the body of the support bracket

In another form of the invention the expansion tubes / rotation ram assembly is vertically mounted and the extendable end of the rotation ram is attached to a rotatable link by a universal coupling, the link in turn is pivotally pinned to the main support bracket. This arrangement of components permits the operation and rotation of an array of a number of solar panels placed side by side on a common frame. The materials used in the construction of the solar tracking device could be any suitable metal; injection moulded re-enforced plastic or a combination of both.

To assist with the understanding of the invention, reference will be made to the accompanying drawings,

FIG.1 shows an isometric view of a single panel solar tracking device made according to the invention.

FIG. 2 shows an isometric view of a multiple panel solar tracking device made according to the invention.

FIG. 3 shows an exploded view of FIG. 1 showing the major component parts.

FIG. 4 shows an exploded view of the thermal hydraulic cylinder as used in FIG. 1

FIG. 5 shows an exploded view of the rotation ram assembly as used in FIG. 1.

FIG. 6 shows side views of the solar tracker seen in FIG. 1. Demonstrating the way by which the expansion tubes are alternately heated by solar radiation and cooled by being rotating into shade to promote an automatic control of the turning effect of the rotation ram.

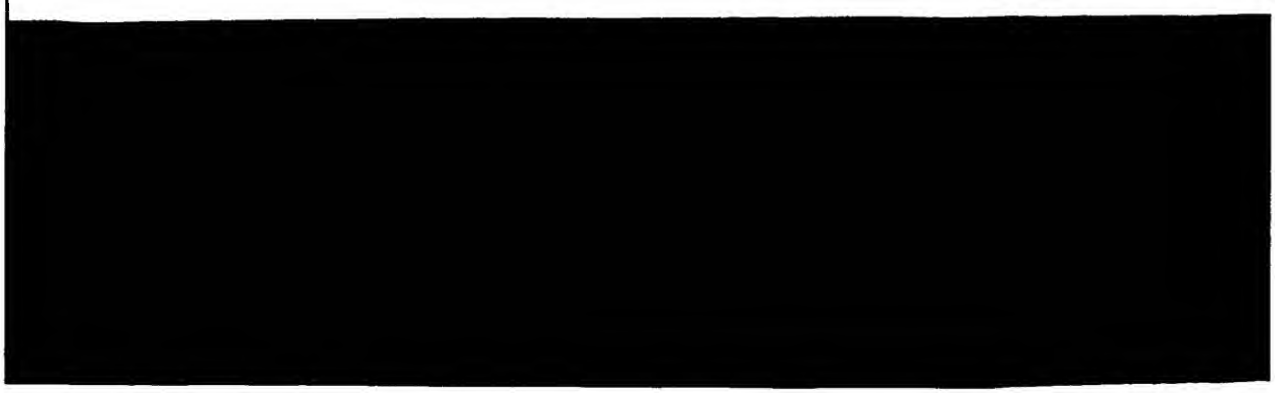


FIG. 7. Is an exploded view of the device seen in FIG. 2 showing the major components.

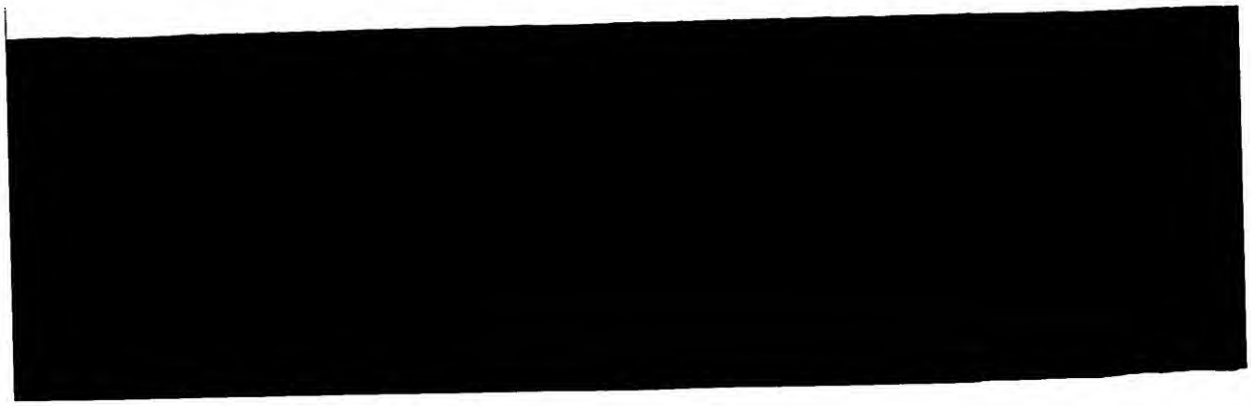
FIG. 8. is an end view of the device shown in FIG. 2. demonstrating the alternate heating and cooling of the expansion tubes by solar radiation and shade.

Referring to FIG.1, FIG.3, FIG.4 and FIG. 5, It can be seen that the solar tracking device according to this invention is comprised of solar collector panel 1, main support bracket 2, two axis pivot tube 3, panel support brackets 4 and 5, expansion tubes 6 and 7, rotation ram assembly 8, adjuster cap 9, displacement ram 10, compensator link 11, thermal hydraulic cylinder assembly12, shoulder screws 13, insulating bushes 14, compensator pivot pins 15, displacement ram 16, clevis 17, pivot pins 18, 19 and 20, bleed screw 21, sealing gland 22, damper plate 23, retainer nut 24, and return spring 25.

The operation of the solar tracking device according to this invention commences with solar panel 1. tilted eastward to its furthermost extent, this is the starting point for the daily rotation of the panel, also during mid winter the fluid contained in both the thermal hydraulic cylinder and the expansion tube / rotation ram assembly contracts to minimum volume, withdrawing the displacement ram 16 into cylinder 12 causing pivot tube 3 and all attached components to tilt toward the north. When the ambient air temperature is coldest a vacuum is formed inside cylinder 12, thus preventing the initial expansion of the fluid contained therein from displacing the ram 16 during mid winter. As the ambient temperature increases with the seasonal cycle, the liquid expands accordingly and begins to apply a pressure on the ram 16 and gradually raises the solar collector panel until maximum height is reached in mid summer.

The expansion tubes 6 and 7 are exposed to both ambient heat from the surrounding air and radiant heat directly from the sun. The fluid volume contained therein is sufficient to allow for expansion of the fluid and apply a force to the displacement ram 10 so that the solar panel will rotate from the initial eastward position to just past horizontal during the hottest part of the day. The expansion tubes 6 and 7 being exposed to direct solar radiation effect further expansion of the contained fluid. As the solar panel rotates, the tubes 6 and 7 fall into partial shadow and gradually cool. This heating, cooling cycle continues until the panel is rotated to its furthermost westerly position. When the sun sets the fluid cools and contracts allowing the return spring 26 to rotate the panel assembly back to the morning start position. The compensator link adjusts the morning start position of the rotation ram 10, to compensate for seasonal changes of the expansion tube / rotation ram fluid volume. This is done by pivoting the link 11 on independent pivot pins and allowing the link / rotation pin 28 to remain parallel to, but change distance from the two axis pivot tube 3. thus allowing a smaller expansion of fluid to initiate rotation.

It is believed that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the device described without departing from the spirit and scope of the invention or sacrificing any of its material advantages, the form hereinbefore described being merely preferred embodiments thereof.



## ABSTRACT

A solar tracking device is disclosed. The device is a mounting bracket (2) fitted with a thermal hydraulic cylinder (12), displacement ram (16), two-axis pivot (3) and compensating link (11). A solar collector panel (1) is carried by two brackets (4)and (5) through the outer ends of which is mounted a pair of expansion tubes (6) and(7) attached to a rotation ram assembly (8). The displacement ram (16) is connected to the compensating link (11) by pin (27). Automatic tracking of the solar collector panel (1) occurs when ambient and radiant heat expands a liquid contained in the expansion tubes (6) and (7) and thermal hydraulic cylinder (12) whereby pressure is applied to displacement rams (10) and (16) rotating the components to which they are pivotally attached. The device can be used to maintain the optimal presentation of the solar collector panel surface to the sun.


**The claims defining the invention are as follows:**

1. **A solar tracking device having one or more hydraulic cylinders and displacement rams, the displacement of which is caused by variation of convection and radiant heat and used as the sole power source to rotate a solar collector panel and maintain an optimal alignment with the Sun.**
2. **The solar tracking device of claim 1. where the solar collector panel is comprised of photovoltaic cells.**
3. **The solar tracking device of claim 1. where the solar collector panel is comprised of metal, plastic or ceramic for the purpose of heating a fluid for domestic, industrial or commercial hot water production.**
4. **The solar tracking device of claim 1. where the solar collector panel is comprised of a photovoltaic cell array and a built in heat exchanger for the purpose of cooling the solar collector panel.**
5. **The solar tracking device of claim 4. where the built in heat exchanger is used for heating fluid.**

**Michael Terrence Patterson** DATE 17-10-02.

**Christopher Paul Geddes**

**Leslie John Jones**

[redacted]

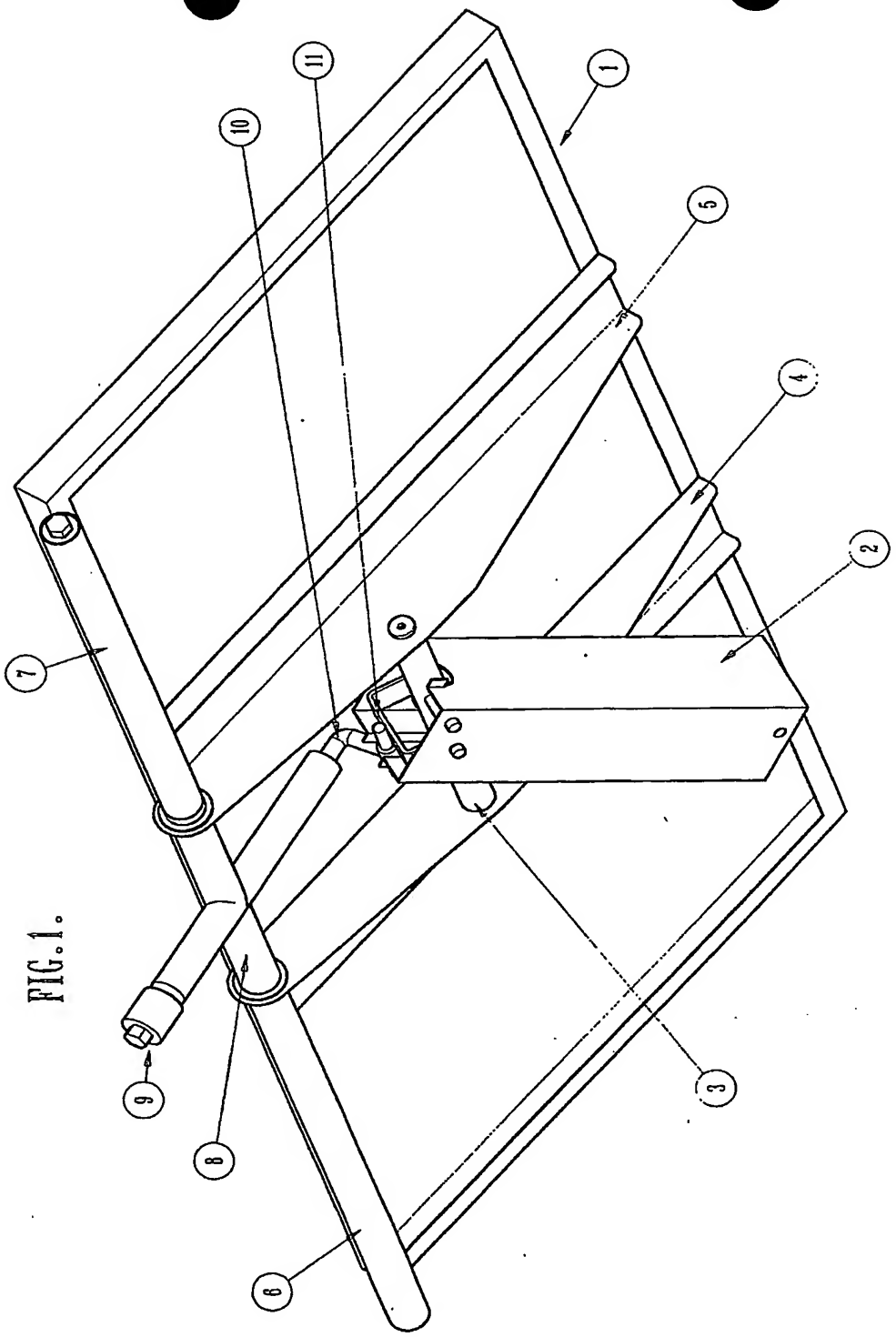
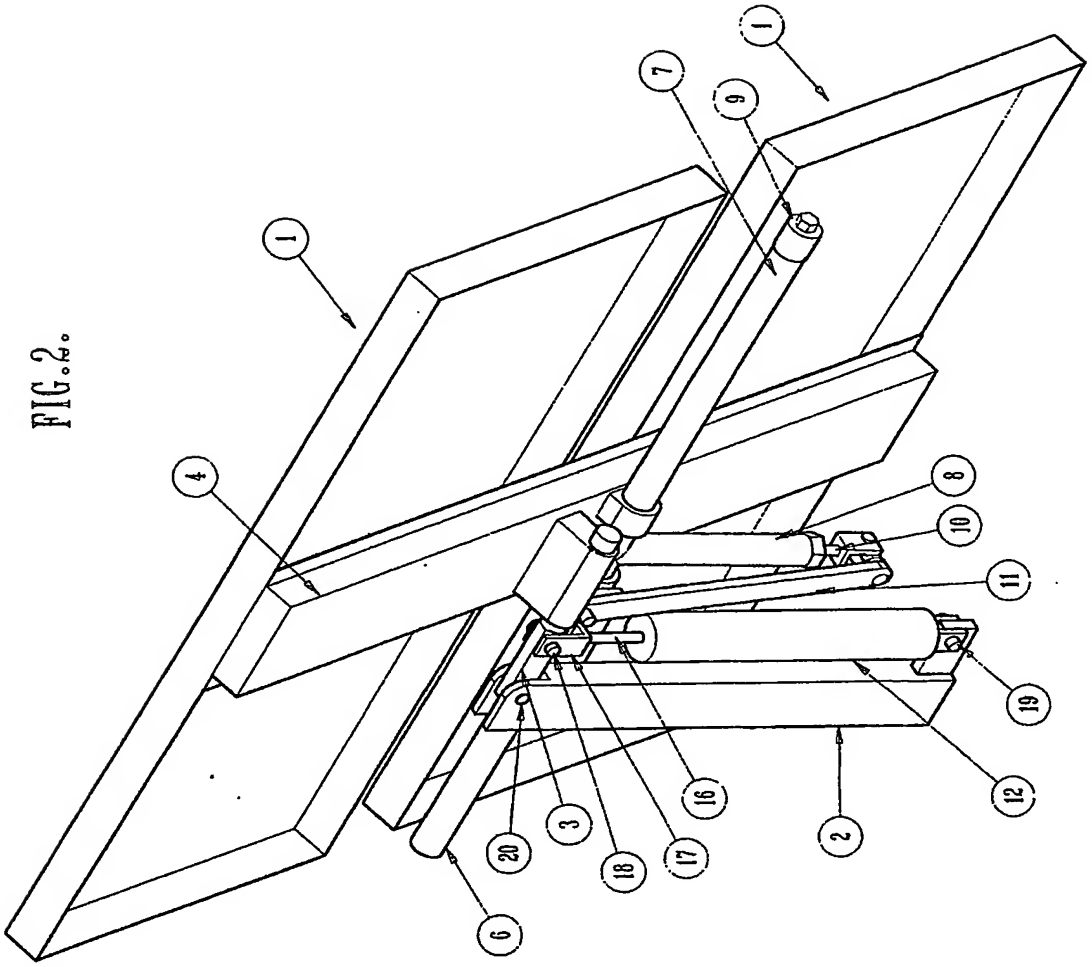



FIG. 1.

FIG.2.



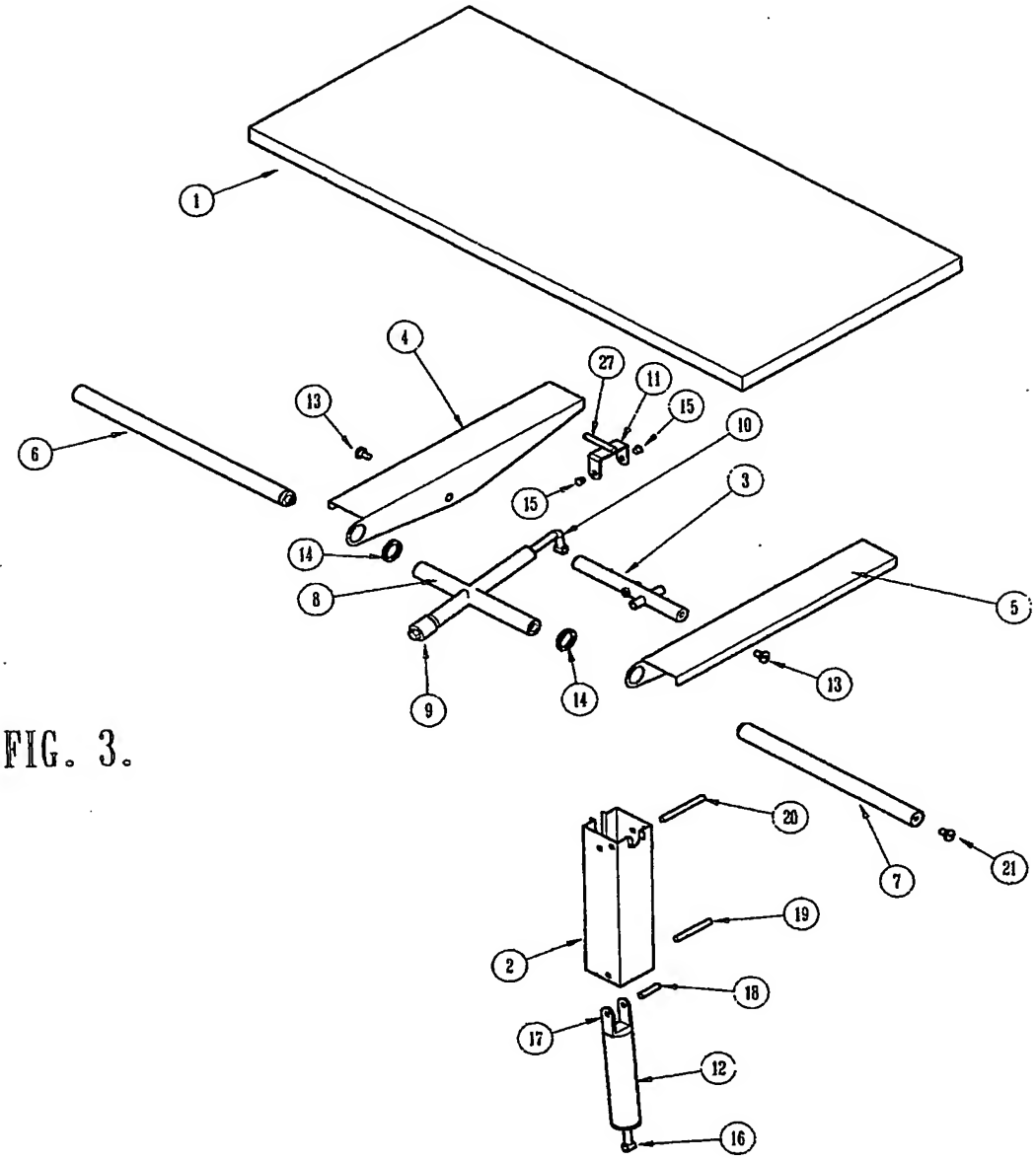



FIG. 3.

FIG.4.

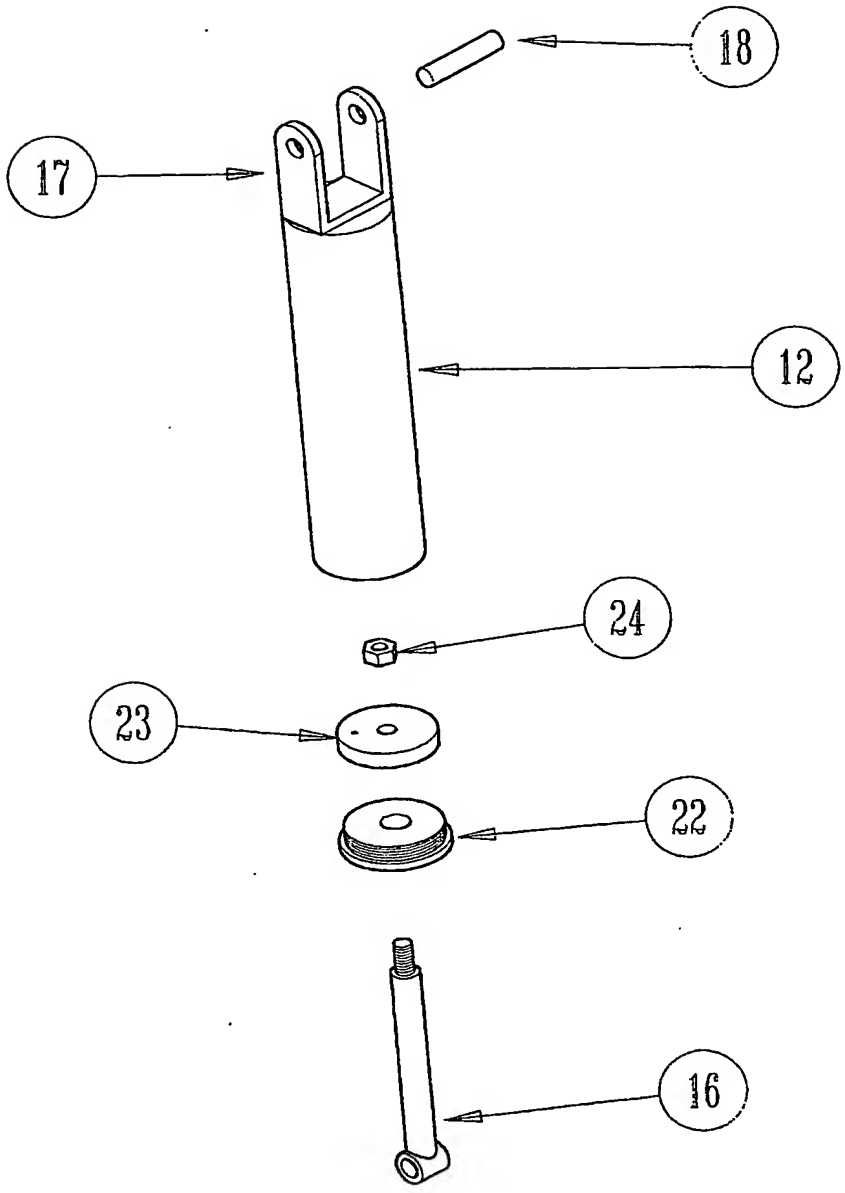


FIG.5.

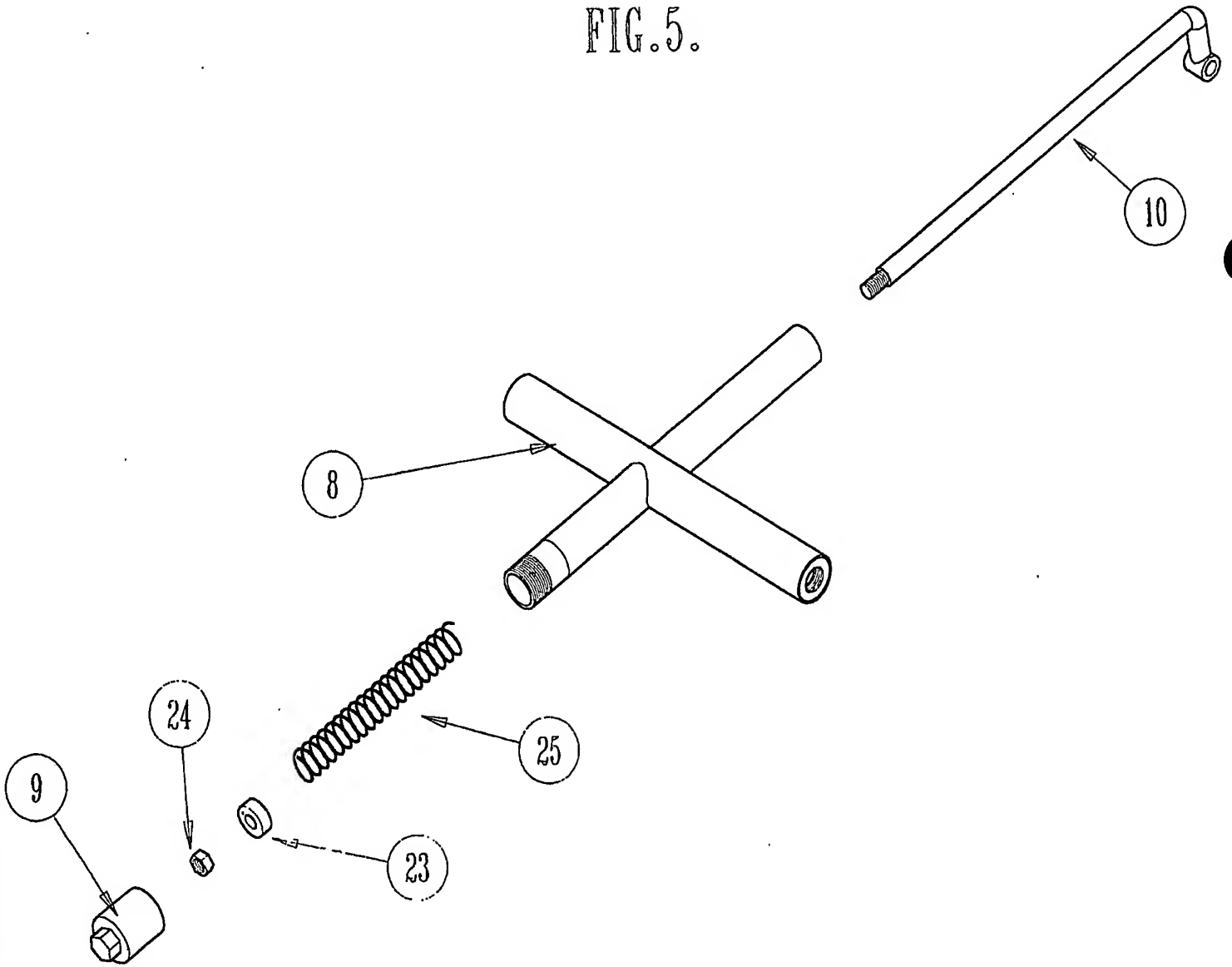
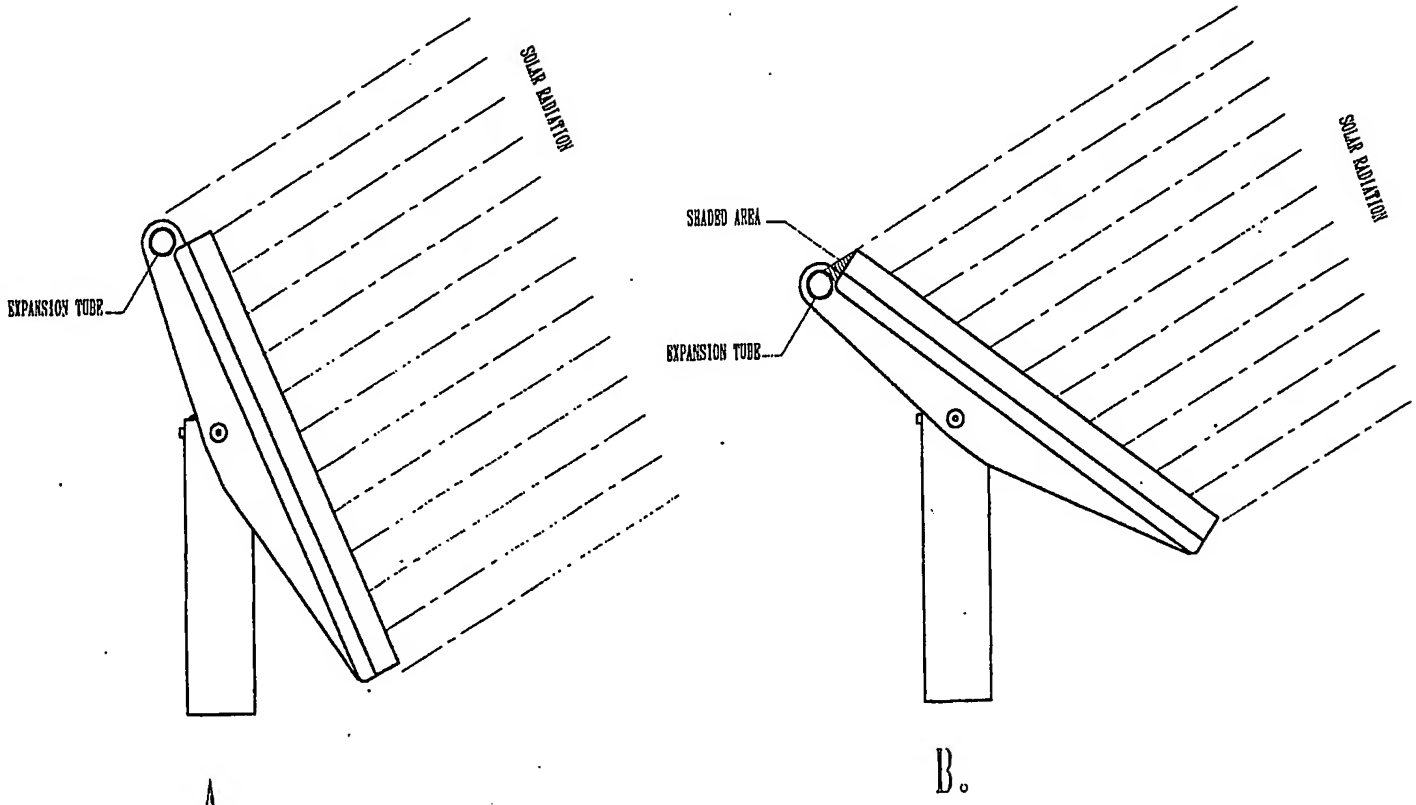


FIG.6.


SOLAR RADIATION
EXPANSION TUBE
SHADED AREA
SOLAR RADIATION
EXPANSION TUBE

A.

B.

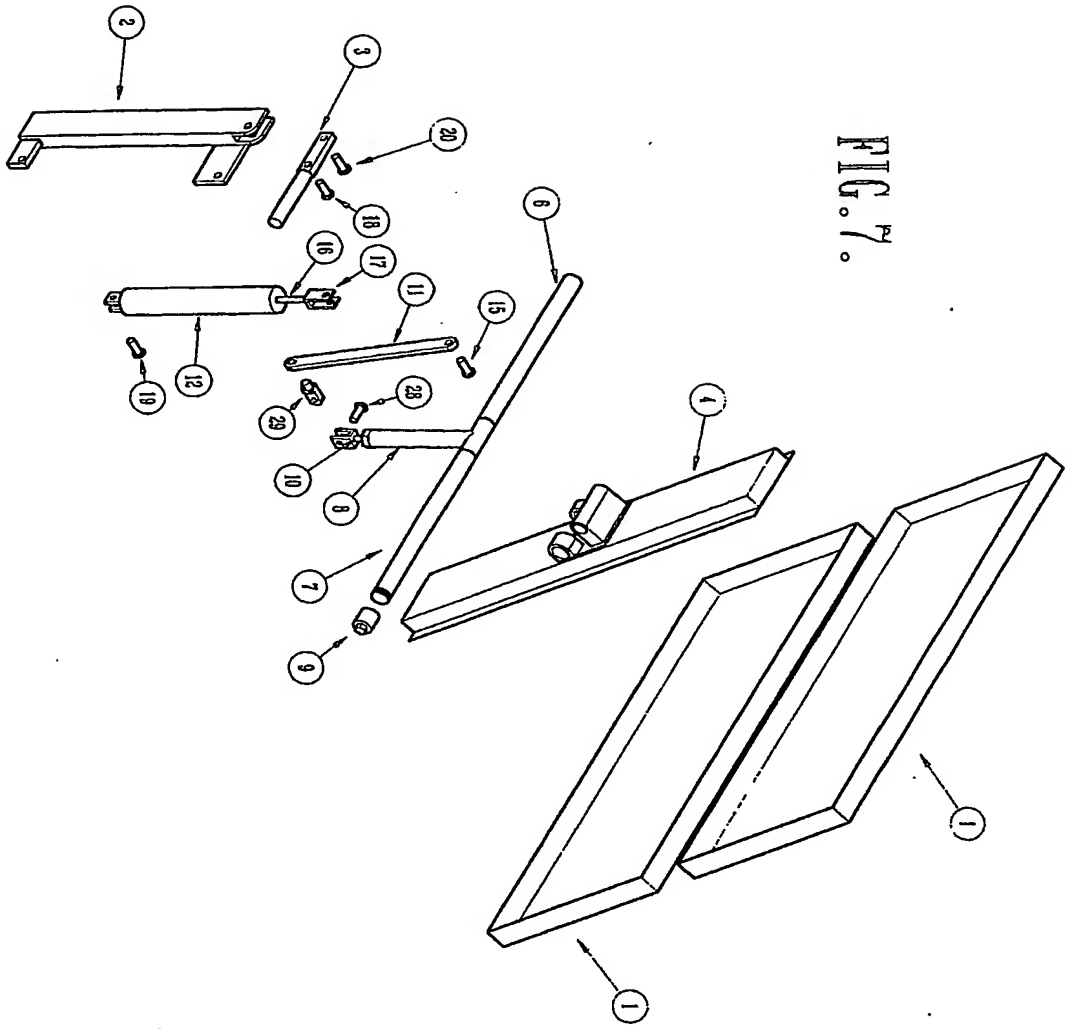



FIG. 7.

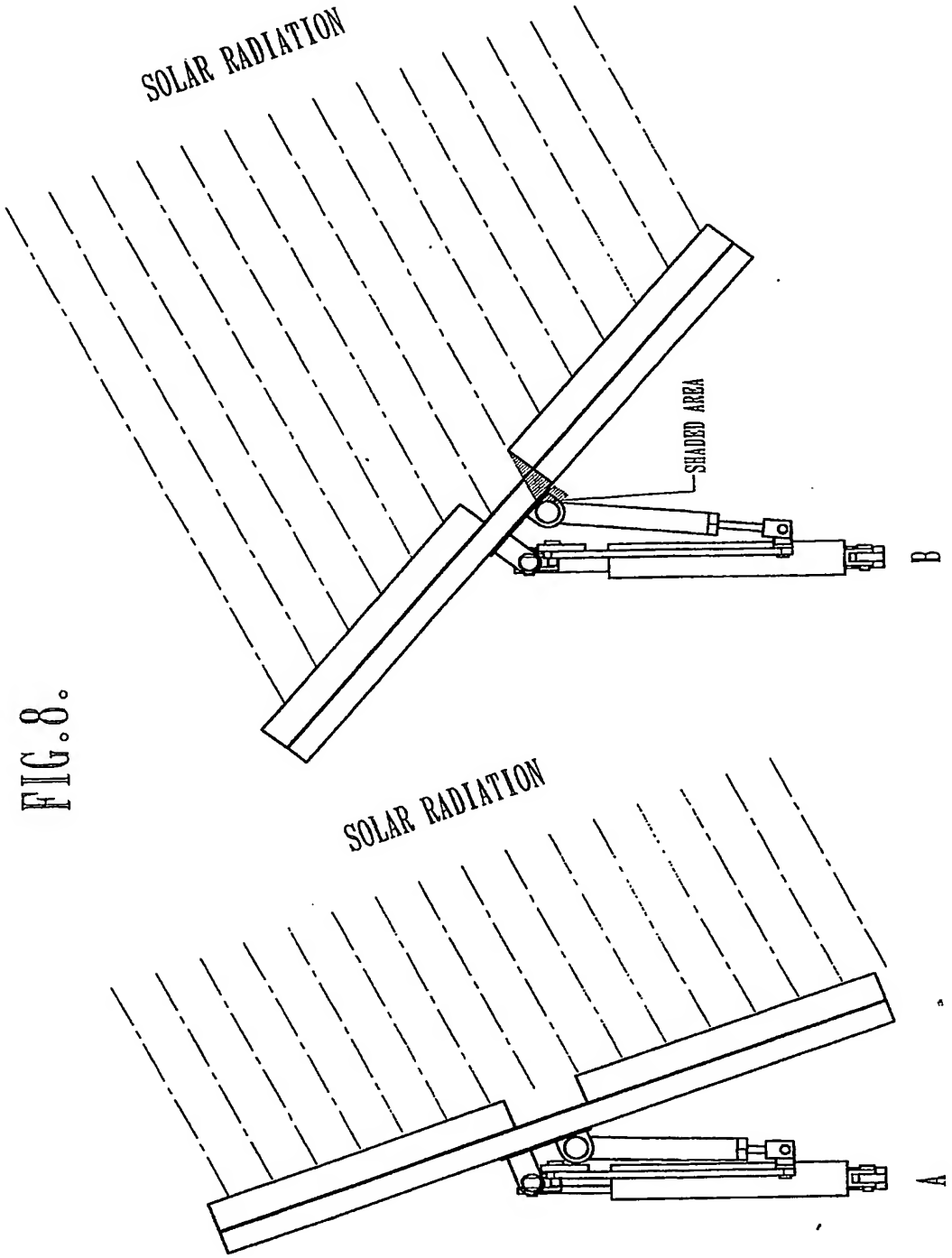



FIG.8.